Validation of the Sinhala version of the Repeatable Battery for Assessment of Neuropsychological Status (RBANS)

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Abstract

Introduction Only the Mini mental state examination (MMSE) and Montreal Cognitive Assessment scale have been validated in a Sri Lankan population for the assessment of cognitive functions. Both tests are deficient in the number of domains assessed. Therefore validation of Repeatable Battery for Assessment of Neuropsychological Status is important as it assesses most of the cognitive domains.

Objectives To culturally adapt RBANS and investigate the validity and reliability of culturally adapted RBANS (RBANS-S).

Methods Fifty four participants with major neurocognitive disorder and 60 normal controls aged >50 were administered with RBANS-S at the Cognitive Assessment Unit, Faculty of Medicine, Colombo and National Hospital of Sri Lanka. The participants were selected after a detailed clinical assessment according to Diagnostic and Statistical Manual – 5 criteria. Data were analysed using SPSS data package.

Results The mean age of the sample was 69.5 years. RBANS-S total scale correlated highly with MMSE total score,(Pearson correlational coefficient = 0.793 *p*=0.01). Criterion validity was assessed using receiver operating curve characteristic analysis and the area under the curve was 0.937. RBANS-S showed strong concurrent validity us indicated by its significant correlations with the MMSE. All of the RBANS-S subtests demonstrated significant correlations with the MMSE subsets. The sensitivity and specificity for RBANS-S was 89% and 85% respectively at a totals score of 80.5. The RBANS-S yielded a reliability coefficient of 0.929.

Conclusions Culturally adapted RBANS-S is a valid and reliable instrument which can be used in assessment of cognitive functions.

Ceylon Medical Journal 2016; **61**: 163-170
http://doi.org/10.4038/cmj.v61i4.8383

Introduction

The Repeatable Battery for Assessment of Neuropsychological Status (RBANS) is a brief neurocognitive battery which measures immediate and delayed memory, attention, language, and visuospatial skills. It has four alternate forms which facilitates repeated testing. It takes approximately 30 minutes to administer. The level of difficulty is appropriate for a range of subjects from normal adults to patients with moderately severe dementia. Existing standardized neuropsychological tests are difficult for people with cognitive impairment to complete and many screening instruments for dementia are insensitive to mild cognitive impairment. In contrast RBANS is sensitive in detecting both mild and severe cognitive impairment. RBANS was primarily developed for use as a stand-alone "core" battery for the detection and characterisation of dementia in the elderly. RBANS can be used to measure the cognitive profiles in Alzheimer's dementia, vascular dementia, human immunodeficiency virus (HIV) dementia, Huntington's disease, Parkinson's disease, major dep-ression, schizophrenia and closed head injury.

Mini Mental State Examination (MMSE) and Montreal Cognitive Assessment (MoCA) scale, are commonly used as bedside screening tests to assess cognitive functions. The Cambridge Cognitive Examination (CAMCOG) and Cambridge Mental Disorders of the Elderly Examination (CAMDEX) are more detailed tests which take a longer time to administer [1]. The MMSE has been translated and culturally adapted for use in Sri Lanka [1]. MMSE has high sensitivity in detection of moderate-to-severe cognitive impairment [2-4]. The MMSE has low sensitivity in detecting mild cognitive impairment (MCI). The MoCA was developed to assess MCI and is able to differentiate between normal, MCI and early dementia. The MMSE has been culturally adapted to Sri Lankan population. However, although MMSE is sensitive for moderate-to-severe cognitive impairment it is has a lower sensitivity for mild degrees of cognitive impairment [2]. The MoCA which was developed as a

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tool to screen patients with mild cognitive complaints addresses the problem of detecting mild cognitive impairments and early dementia. The original validation of MoCA reported a sensitivity of 100% and specificity of 87% in detecting mild Alzheimer's disease at a cut-off 26 with a sensitivity of 90% in detecting MCI which has been replicated in studies carried out in many countries [5, 9]. MoCA has been translated into 36 languages and its validity in detecting cognitive impairment in different clinical populations like Parkinson disease, brain metastases and strokes has been established.

Cognitive assessment tools need to be translated and culturally adapted. Some concepts used in the tools may not exist in particular cultures and may result in conceptual bias. Item bias may occur when people from different cultures are unfamiliar with items. Therefore cognitive assessment tools should be translated and culturally adapted before use in a particular culture. Because only a few cognitive assessment instruments have been culturally adapted and validated for use in Sri Lankan populations we translated the RBANS to Sinhala, and validated it.

Methods

The translation and cultural adaptation of RBANS was done by using qualitative and quantitative approached. The forward translated RBANS-S was checked by a group of experts consisting of a consultant psychiatrist, a Senior Registrar in psychiatry and two Senior Registrars in community medicine for semantic, idiomatic, experiential and conceptual equivalence. The scale was back translated in to English by an independent bilingual expert who was not familiar with the original RBANS. The translated instrument was pretested in 20 individuals with major NCD over the age of 50 years in which the validated instru-ment would be used. No changes were made by the expert panel following the pretesting. Sample size was calculated to detect a targeted sensitivity of 85% and a specificity of 85% which required 50 patients and 49 normal controls.

Participants

The study sample consisted of 54 participants diagnosed with major neurocognitive disorder (NCD) due to Alzheimer's disease diagnosed according to DSM-5 criteria and 60 normal controls aged over 50 years. Patients with major NCD were recruited from the University Psychiatry Unit of the National Hospital of Sri Lanka, Colombo. The controls were recruited from the community.

Study procedure

The diagnosis of neurocognitive disorder was made based on a detailed clinical interview by a consultant or Senior Registrar in psychiatry and results of investigations. All patients with major neurocognitive disorder underwent biochemical screening and a neuro-imaging tests (CT scan or MRI) to exclude other causes of NCD and cognitive impairment. In the control group neurocognitive disorder was excluded after a clinical interview.

Those with visual impairment, hearing impairment or learning disability were excluded as these deficits compromise the ability to complete the test. In the control group those who complained of memory or cognitive impairment, had a history of head trauma, stroke, depressive illness, psychotic illness or were disoriented were excluded.

A doctor who was blind to the clinical diagnosis and trained in administering of RBANS-S and MMSE administered the instruments to all participants.

All subjects and their primary caregiver were informed of the aims and methods of the study, and their informed consent was obtained.

Ethical issues

Ethical approval was obtained from the Ethical Review Committee of the National Hospital of Sri Lanka. Written informed consent was obtained from the study participants and their primary care giver. RBANS was purchased for use.

Statistical analysis

Statistical analysis was carried out using SPSS version 18.0. Internal consistency was measured using Cronbach's alpha. Concurrent validity was assessed using Pearson correlation coefficients between the RBANS-S and MMSE scores. Criterion validity was assessed using receiver operating characteristic (ROC) analysis where clinical diagnosis according to DSM-5 criteria was used as the gold standard.

Results

A total of 114 participants were included in the study (Table 1). The study sample consisted of 54 patients with major NCD and 60 normal people aged ≥50 years. The mean age was 69.5 years (SD = 9.9 range = 50-88 years). The difference in ages was not statistically significant

Table 1. The demographic data of the sample

		Major NCD N (%) Total 54	*Controls N (%) Total 60*
Gender	Male	31 (57.4)	23 (38.9)
	Female	23 (42.6)	37 61.7)
Age in years	50-59	5 (9.3)	15 (25)
	60-69	14 (25.9)	22 (36.7)
	70-79	9 (35.2)	20 (33.3)
	80-89	16 (29.6)	3 (5)

(p=0.8). There were less females in the major NCD group and less males in the control group (Table 1). However, this was not statistically significant (p= 0.06).

The mean total score of RBANS-S for the whole sample was 81.16 (SD = 24.15). Attention index was the highest with a mean of 113.01 (SD = 26.04). The delayed memory was the most affected with a mean score of 70.52. The mean total score in RBANS-S in the partici-pants with major NCD was 62.26 (table 2). They too had comparatively higher mean scores (99.22) in the attention index. The delayed memory was the most effected with a mean score of 50.50. The mean total score in the control sample was 98.17 (SD = 17.29). The attention index was the most preserved with a mean score of 125.42. Immediate memory was the most effected with a mean score of 86.48.

Table 2. Mean score in participants with major NCD and controls

	Major NCD Mean (SD)	*Control Mean (SD)*
Immediate memory	57.72 (12.961)	86.48 (16.29)
Visuospatial/constructional	67.44 (19.102)	101.38 (23.09)
Language	68.17 (15.84)	90.22 (16.56)
Attention	99.22 (30.67)	125.42 (11.11)
Delayed memory	50.50 (14.06)	88.53 (18.36)
Total scale	62.26 (14.78)	98.17 (17.29)

Validity

Face validity was confirmed by a group of experts. Concurrent validity was assessed using Pearson correlation coefficients between the RBANS-S scores and MMSE scores. The total scale score was highly correlated with MMSE total score (r=0.793, p = 0.01). The correlation coefficient for each of the individual items with the corresponding component of MMSE is depicted in Table 3. Visuospatial/Constructional index showed the highest correlation (r=0.639, p = 0.01) while immediate memory index showed the lowest correlation (r=0.203, p = 0.01).

Table 3. Correlation coefficient for individual items of RBANS-S with corresponding subsets of MMSE

Item	*Correlation coefficient*	*Significance*
Immediate memory	0.203	0.01
Visuospatial/Constructional	0.639	0.01
Language	0.449	0.01
Attention	0.528	0.01
Delayed memory	0.519	0.01

Criterion validity was assessed using receiver operating curve characteristic (ROC) analysis (figure 1). The area under the curve was 0.937 with a standard error of 0.021 with a 95% confidence interval of 0.896 - 0.979.

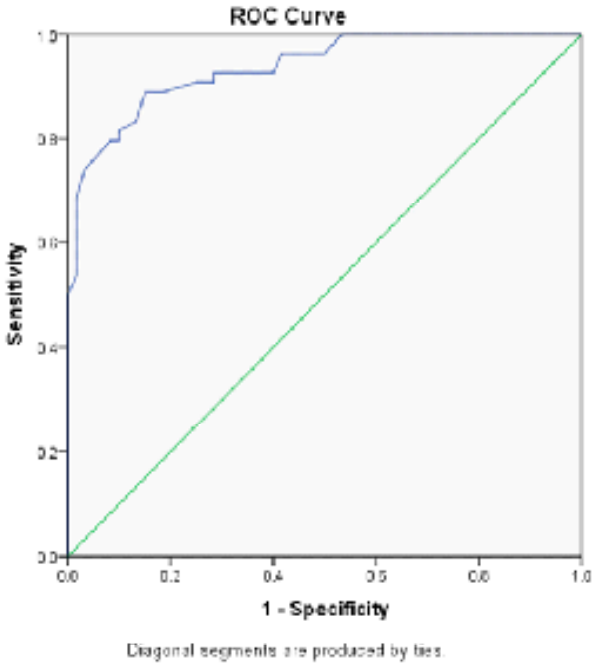

Figure 1. **ROC curve for RBANS-S.**

A total scale value of 80.5 yielded sensitivity of 89% and specificity of 85% in detecting dementia. The positive likelihood ratio at this value was 5.93 with a negative likelihood ratio of 0.73.

Reliability

Cronbach's alpha for the total scale showed strong internal consistency (r=0.929). The Coefficient alpha value for each of the RBANS scales ranged from 0.506 to 0.888 (Table 4). The strongest correlation was seen between Visuospatial/Constructional index and total scale (r=0.808) while the weakest was observed between attention and language indices (r=0.506).

Discussion

The validated RBANS-S yielded a reliability coefficient of 0.929 which is comparable to the value given in the original study of 0.88. The value for RBANS-S shows higher reliability coefficient than for the Chinese RBANS which is 0.806 [6]. The concurrent validity of RBANS-S was 0.793 which was significant (p=0.01) and corresponding value for the Chinese version of RBANS was 0.594 [6]. The concurrent validity for RBANS-S was good.

Our study confirms the findings that RBANS-S is valid for cognitive assessment in different populations. The values of reliability and validity were comparable or higher than those obtained from previous studies [6, 7]. Although MMSE has some limitations, it was used to validate RBANS-S over other instruments like MoCA, as it has been repeatedly used in dementia studies, particularly as a "standard" easily communicated and cited tool [8]. MMSE enables results to be compared across many

Table 4. Inter-item correlational matrix

	Immediate memory	*Visuospatial/ Constructional*	*Language*	*Attention*	*Delayed memory*	*Total scale*
Immediate memory	1.000	.673	.625	.537	.776	.859
Visuospatial/ Constructional	.673	1.000	.706	.615	.676	.888
Language	.625	.706	1.000	.506	.645	.817
Attention	.537	.615	.506	1.000	.530	.728
Delayed memory	.776	.676	.645	.530	1.000	.876
Total scale	.859	.888	.817	.728	.876	1.000

studies. MMSE is also better for differentiating various degrees of dementia than for example MoCA which is better for differentiating MCI from normal ageing. RBANS-S showed strong concurrent validity based on its significant correlation with the MMSE. Although correlation coefficients between the RBNAS-S scores and the MMSE total scores were high, the correlation coefficients for the individual items were low, particularly immediate memory (r=0.203) and language (r=0.449). This may influence the use of RBANS-S in different conditions particularly where specific impairment is seen in different cognitive domains. Strong correlation was seen in the visuospatial/constructional subset.The sensitivity and specificity for RBANS-S was 89% and 85% respectively at a total score of 80.5.

RBANS-S has good reliability and validity. RBANS is validated in many conditions cognitive impairment, such as NCD, schizophrenia, Parkinson disease and head injury. Another advantage is that this tool is able to detect cognitive impairment in a wide spectrum from normal population to patients with severe NCD. RBANS asses several cognitive domain in depth which is also an advantage. Therefore RBANS-S will be of great value to clinicians in Sri Lanka in objectively assessing and monitoring of patients with cognitive impairment as the existing validated scales like MMSE and MoCA do not have these strengths.

There were several limitations in our study. A "case-control" sampling design was chosen instead of screening a large population as the prevalence of major NCD was low. We have validated RBANS only in those with major NCD and not in the population of people with mild NCD. This is a limitation as one of the important uses of RBANS is its ability to detect mild NCD. The number of participants of different age groups may be inadequate which has introduced some bias to the study results. This is reflected in some of the findings particularly as the number of participants in the 50-59 and 80-89 age group is less than the other two age groups. Although there were elderly above the age of 89, they were excluded from the study due to lack of normative data for the participants in that age group. Some of the previous studies on RBANS have indicated that the findings may be confounded by the educational status of the participants apart from the age. Therefore a limitation of the study was that the educational status was not accounted for. The results would be more robust if the study participants were matched according to age and sex as well. As RBANS is lengthy it was felt that performance of the participants were deteriorating particularly towards the latter part of tool which may have an impact on the ultimate cumulative results. As the attention is anyway impaired among the elderly, this is a potential confounding factor particularly when administering line orientation where they had to concentrate on 20 different lines and coding which consisted of 89 different codes.

The findings from our study reveals that culturally validated RBANS-S can be used to evaluate the cognitive functions as it shows good reliability and validity.

Conflicts of interest

There are no conflicts of interest.

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